SEMICONDUCTOR IMAGE SENSING ELEMENT AND FABRICATION METHOD THEREFOR, AND SEMICONDUCTOR IMAGE SENSING DEVICE AND FABRICATION METHOD THEREFOR

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The teachings of Japanese Patent Application JP 2005-332247, filed Nov. 17, 2005, are entirely incorporated herein by reference, inclusive of the specification, drawings, and claims.

BACKGROUND OF THE INVENTION

[0002] The present invention relates to a semiconductor image sensing element having an optical member bonded directly to the image sensing area thereof and a fabrication method therefor, and to a semiconductor image sensing device and a fabricating method therefor. More particularly, the present invention relates to a structure which cuts off a light beam incident from a side surface of an optical member.

[0003] In recent years, as electronic equipment has been increasingly reduced in size, thickness, and weight, there has been stronger demand for a more densely packed semiconductor device. In accordance with the trend toward higher integration of a semiconductor element promoted by the advancement of microfabrication technologies, a so-called chip mounting technology which directly mounts a chip size package or a bare-chip semiconductor element has been proposed. Such trends are the same also in a semiconductor image sensing device and various structures have been proposed.

[0004] For example, there has been proposed a method for fabricating semiconductor packages which are constructed to have no through-hole conducting portion to prevent the fabrication process thereof from being complicated by the provision of through holes and which can also be thinned and simultaneously fabricated (see, e.g., Japanese Laid-Open Patent Publication No. 2004-111792).

[0005] Each of the semiconductor packages fabricated by the method comprises: a semiconductor substrate having a device region on one surface thereof and connection pads connected to the device region; a support substrate provided on the one surface of the semiconductor substrate; external electrodes provided on the other surface of the semiconductor substrate; and connecting means having a part thereof extending outwardly from the periphery of the semiconductor substrate and providing electrical connection between the connection pads and the external electrodes. In the structure, an image sensing area and the support substrate are provided on the one surface of the semiconductor substrate having the connection pads connected to the image sensing area, while columnar electrodes are provided on the other surface thereof. The arrangement allows the formation of the structure that can be thinned and has no through-hole conducting portion since the connecting means providing electrical connection between the connection pads and the columnar electrodes is partly extended outwardly from the periphery of the semiconductor substrate. In addition, since the connecting means and the columnar electrodes of the plurality of semiconductor substrates can be formed simultaneously, the productivity can be reportedly improved.

[0006] A solid-state image sensing device free from the occurrence of flare, smear, or the like irrespective of its structure molded with a resin and highly reliable in terms of moist resistance, mechanical strength, and the like and a fabrication method therefor have also been proposed (see, e.g., Japanese Laid-Open Patent Publication No. HEI 05-102449).

[0007] The solid-state image sensing device according to this example is comprised of a structure obtained by entirely molding a solid-state image sensing element wired on a lead frame with a transparent resin and covering the outer circumferential surfaces of the transparent resin, except for at least the surface thereof corresponding to a valid pixel area, with a black resin. The fabrication method for the solid-state image sensing device comprises the steps of: molding the entire solid-state image sensing element wired on the lead frame with the transparent resin; covering the entire transparent resin with the black resin; and locally removing the black resin from over the valid pixel area of the solid-state image sensing element.

[0008] In such a structure, the solid-state image sensing element molded with the transparent resin is covered with the black resin except for at least the surface thereof corresponding to the valid pixel area. Accordingly, the black resin shields the solid-state image sensing element from a light beam, except for the light receiving surface thereof. This prevents flare, smear, and the like which adversely affect an image sensed by the solid-state image sensing device. It is also reported that the formation of the light receiving surface achieved by integrally molding the solid-state image sensing element with the transparent resin, covering the transparent resin with the black resin, and locally removing the black resin from over the valid pixel area allows easy fabrication of a highly reliable resin-molded solid-state image sensing device.

SUMMARY OF THE INVENTION

[0009] In the semiconductor image sensing device according to the first example mentioned above, the optical member such as a glass substrate is bonded to at least the surface of the semiconductor substrate which has the image sensing area by using a transparent bonding layer made of a transparent epoxy resin. In such a structure, however, there is a case where an incident light beam impinges on wiring for connection on the surface of the semiconductor image sensing element and the reflected light beam therefrom is further reflected by the transparent bonding layer and the optical member so that the reflected light beam is incident on the image sensing area. When such a phenomenon occurs, optical noise occurs and significantly degrades the quality of the semiconductor image sensing device.

[0010] In the semiconductor image sensing device according to the second example, the solid-state image sensing element wired on the lead frame is entirely molded with the transparent resin and the outer circumferential surfaces of the transparent resin, except for at least the surface thereof corresponding to the valid pixel area, is covered with the black resin. However, the transparent resin layer is exposed at the image sensing surface including gold wire portions, which are metal thin wires. This is because the image sensing surface is polished after the transparent resin is entirely covered with the black resin. In this structure,